REMARKS

Overview of the Office Action

Claims 1 and 3 have been rejected under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 6,107,678 ("Shigeta").

Claims 6-8, 10, and 11 have been rejected under 35 U.S.C. §103(a) as unpatentable over Shigeta.

Claims 9, 12, and 16-18 have been rejected under 35 U.S.C. §103(a) as unpatentable over Shigeta in view of U.S. Patent No. 3,781,596 ("Galli").

Claims 13-15 and 19 have been rejected under 35 U.S.C. §103(a) as unpatentable over Shigeta in view of Galli, and further in view of U.S. Patent No. 4,812,421 ("Jung").

Status of the claims

Claims 2, 4, and 5 have been previously canceled.

Claims 1 and 3-19 remain pending.

Rejection of claims 1 and 3 under 35 U.S.C. §102(b)

The Office Action states that Shigeta teaches all of Applicants' recited elements. Applicants' disagree.

Before discussing the cited prior art and the Examiner's rejections of the claims in view of that art, a brief description of the subject matter described in the present application is deemed appropriate to facilitate understanding of the arguments for patentability. The description is not meant to argue unclaimed subject matter.

Applicants' recited invention is directed to a surface-mountable miniature luminescent diode or photodiode where the components are arranged in the following order: a metal foil 12, then a plastic film 14 with openings 34, 36, and then a semiconductor chip 22, which is mounted on the metal foil 12 in an opening 34 of the plastic film 14. That is, both the plastic film 14 and the semiconductor chip 22 of the presently claimed invention are disposed on the same side of the metal foil 12. Thus, the total thickness of Applicants' recited arrangement is the sum of the thicknesses of the metal foil 12 and the semiconductor chip 22.

It is an object of the invention recited in Applicants' claim 1 to reduce the overall size of the surface-mountable miniature luminescence diode or photo diode (see paragraph [0004] of Applicants' specification). The advantage of Applicants' recited arrangement (i.e., the semiconductor chip 30 contacting the metal foil 12 through an opening of the plastic film 14) is that only the thicknesses of the metal foil and the semiconductor chip contribute to the total thickness of the device. In other words, the plastic film 14 does not contribute to the overall thickness of the device (see Fig. 1 of Applicants' specification).

Applicants' independent claim 1 specifically recites a surface-mountable miniature luminescent diode or photodiode that includes, inter alia, "a semiconductor chip … which comprises a first contact area, a second contact area, and at least one of an active, radiation-emitting region and radiation-receiving region", "a plastic film arranged on, and connected to, the metal foil, the plastic film defining a plurality of openings in regions arranged on the first and the second chip connection regions", and "wherein the semiconductor chip is mounted in one of the plurality of openings of the plastic film with the first contact area contacting the first chip connection region."

As will be described in more detail below, Shigeta fails to teach or suggest the above limitations because the chip in Shigeta is not "mounted in one of the plurality of openings of the plastic film", as recited in Applicants' claim 1.

Shigeta discloses a lead frame with a reinforcing ring surrounding a semiconductor element, which is electrically connected to leads through electrodes. The lead frame is integrally formed through suspending portions. Reinforcing portions for reinforcing the suspending portions are provided on the suspending portions. Upon application of a lead frame forming technique in which a laminate plate of three or more layers is used as a base, and inner leads are formed at one side while outer leads are formed by the surface layer at the other side. The lead frame is formed by forming a ring in place of the outer leads. A semiconductor package is formed by mounting the lead frame on a semiconductor chip (see Abstract of Shigeta).

The Examiner cites Figs. 10E-10H of Shigeta as teaching Applicants' recited invention. Specifically, the Examiner asserts that Figs. 10E-10H show a semiconductor arranged on, and in electrical contact with, a leadframe 113/105, and that the terminals 110 are the connection regions for the semiconductor. The Examiner further asserts that the insulating film 106 and the conductor pattern 105 of Shigeta correspond to Applicants' recited plastic film disposed on a metal foil, and that the semiconductor chip is mounted in one of the plurality of openings of the plastic film 106 with the first contact area contacting the first chip connection region 110. Applicants' disagree and submit that the Examiner has misinterpreted Shigeta.

According to Shigeta, Figs 10A-10H show a manufacturing process of lead frame 113 only without yet attaching a chip (see col. 10, lines 5-6 of Shigeta). The lead frame 113 includes a metal base 101 formed by disposing an aluminum film 103 and a nickel film 104 on a substrate 102 (see col. 10, lines 6-10 of Shigeta). A plurality of lead patterns 105 are then formed on the

surface of the metal base 101 (see col. 10, lines 29-35 of Shigeta). An insulating film 106 is laminated on the lead pattern 105 to form a wiring film 107 and a number of holes 108 are formed in the insulating film 106 (see Fig. 10D and col. 10, lines 44-52 of Shigeta). Leads 109 extending from the pattern 105 are formed as the connection portions to the electrode pads of the semiconductor chip (see Figs. 10F-H, 11A, and 11B, and col. 10, lines 53-59 of Shigeta).

External connection terminals 110, which include solder balls, are formed at the termination of the lead patterns 105 coated with the insulating film 106 (just above the holes 108) by using the insulating film 106 as a mask (see Fig. 10E and col. 11, lines 3-14 of Shigeta). The layers 102, 103, 104 of the metal base 101 are selectively removed leaving an outer ring 111 connected to the wiring film 107 (see Figs. 10F-10G and col. 11, lines 60-65 of Shigeta).

Clearly, Figs 10A-10H show the process for producing/completing the lead frame 113 only, and only depict the leadframe 113 before a semiconductor chip is attached thereto (see col. 11, lines 35-37 of Shigeta).

Fig. 11A of Shigeta shows attachment of a semiconductor chip 115 to the lead frame 113, on a back surface side of the wiring film 107 through an adhesive layer 114 (see Fig. 11A and col. 11, lines 38-44 of Shigeta).

Thus, contrary to the Examiner's assertion, none of the cited Figs. 10E-10H show a semiconductor. Furthermore, since the semiconductor chip 115 is arranged on a side of the lead patterns 105 facing away from the insulating film 106, Shigeta fails to disclose, teach or suggest "wherein the semiconductor chip is mounted in one of the plurality of openings of the plastic film with the first contact area contacting the first chip connection region", as expressly recited in independent claim 1.

Further, connection terminals 110 do not, and are not intended to, connect to any semiconductor chip. The connection terminals 110 are "solder balls" disposed at the end of lead patterns 105 and formed over the holes 108. Furthermore, the connection terminals 110 are the external connections of the package for connection to a printed circuit board or the like. Therefore, terminals 110 of Shigeta do not in any way correspond to Applicants' recited first and second chip connection regions.

Because Shigeta teaches that solder balls/connection terminals 110 are placed over the openings 108 in the plastic film 106, and because the terminals 110 are not in any way used as chip connection regions, Shigeta necessarily fails to teach or suggest "a plastic film arranged on, and connected to, the metal foil, the plastic film defining a plurality of openings in regions arranged on the first and the second chip connection regions", "wherein the semiconductor chip is mounted in one of the plurality of openings of the plastic film with the first contact area contacting the first chip connection region", as recited in Applicants' claim 1.

Further, Shigeta only discloses a semiconductor chip. There is nothing in the disclosure of Shigeta that teaches or suggests that the semiconductor chip is a "surface-mountable miniature luminescent diode or photodiode" that includes "at least one of an active, radiation-emitting region and radiation-receiving region", as recited in Applicants' claim 1.

Additionally, as discussed above, Applicants' invention is concerned with reducing the overall height of the device. According to Applicants' invention, only the thicknesses of the semiconductor and the metal foil contribute to the overall height of the device. The thickness of the plastic film does not contribute to the overall height because of the semiconductor being disposed in an opening in the plastic film (see Fig. 1 of Applicants' published specification).

Shigeta, in contrast to Applicants' invention, is not at all concerned with reducing the overall height of the device. This is evidenced by the device of Shigeta including layers (e.g., the adhesive layer 114) in addition to the metal layer, the semiconductor, and the film layer that increase the overall height of the device.

For all of the above reasons, Applicants submit that Shigeta fails to disclose, teach or suggest the subject matter recited in independent claim 1. Accordingly, claim 1 is patentable over Shigeta under 35 U.S.C. §102(b).

Dependent claims

Claim 3, which depends from independent claim 1, incorporates all of the limitations of independent claim 1 and is, therefore, deemed to be patentably distinct over Shigeta for at least those reasons discussed above with respect to independent claim 1.

Rejection of claims 6-8, 10, and 11 under 35 U.S.C. §103(a)

The Office Action states that Shigeta teaches all of Applicants' recited elements

As previously discussed, Shigeta fails to teach or suggest the subject matter recited in Applicants' amended independent claim 1.

Claims 6-8, 10, and 11, which depend from the independent claim 1, incorporate all of the limitations of independent claim 1 and are therefore deemed to be patentably distinct over Shigeta for at least those reasons discussed above with respect to independent claim 1.

Rejection of claims 9, 12, and 16-18 under 35 U.S.C. §103(a)

The Office Action states that the combination of Shigeta and Galli teaches all of Applicants' recited elements. Applicants' disagree.

As previously discussed, Shigeta fails to teach or suggest the subject matter recited in Applicants' amended independent claim 1. Because Shigeta fails to teach or suggest the subject matter recited in independent claim 1, and because Galli fails to teach or suggest any elements of independent claim 1 that Shigeta is missing, the addition of Galli to the reference combination fails to remedy the above-described deficiencies of Shigeta.

Claim 12 has recites limitations similar to claim 1, which Shigeta and Galli, whether taken alone or in combination, fail to teach or suggest. Therefore, claim 12 is deemed to be patentably distinct over Shigeta and Galli for at least those reasons discussed above with respect to independent claim 1.

Claims 9, 16, and 18, which depend from independent claims 1 and 12, incorporate all of the limitations of the corresponding independent claim and are, therefore, deemed to be patentably distinct over Galli for at least those reasons discussed above with respect to independent claims 1 and 12.

Rejection of claims 13-15 and 19 under 35 U.S.C. §103(a)

The Office Action states that the combination of Shigeta, Galli, and Jung teaches all of Applicants' recited elements.

As previously discussed, Shigeta and Galli fail to teach or suggest the subject matter recited in Applicants' independent claim 12.

Because Shigeta and Galli fail to teach or suggest the subject matter recited in independent claim 12, and because Jung fails to teach or suggest any elements of independent claim 12 that Shigeta and Galli are missing, the addition of Jung to the reference combination fails to remedy the above-described deficiencies of Shigeta and Galli.

Claims 13-15 and 19, which depend from independent claim 12, incorporate all of the limitations of independent claim 12 and are, therefore, deemed to be patentably distinct over Galli and Jung for at least those reasons discussed above with respect to independent claim 12.

Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims is respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

It is believed that no fees or charges are currently due. However, if any fees or charges are required at this time in connection with the application, they may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
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